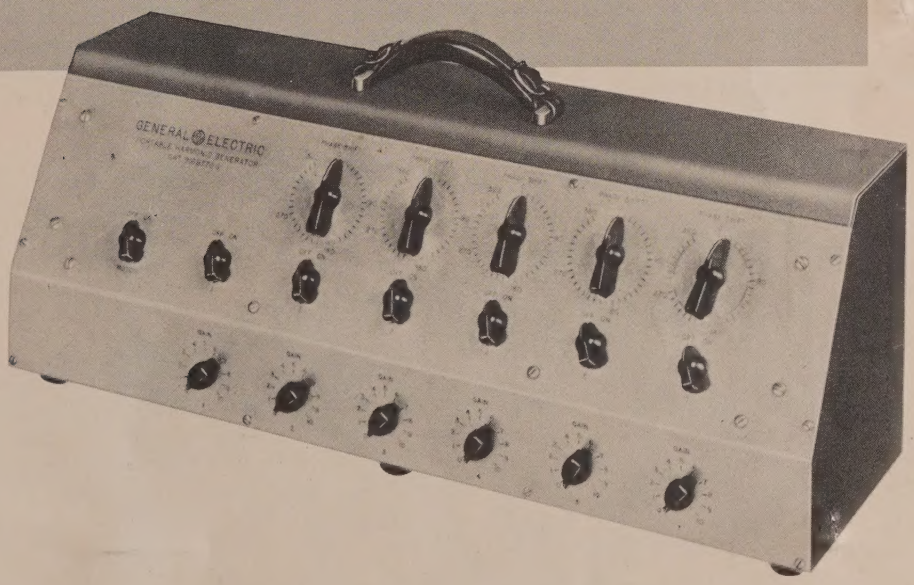
Instructions

PORTABLE HARMONIC GENERATOR

CAT. NO. 9169770G1



GENERAL ELECTRIC

MP MASTER
MA32688

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the General Electric Company.

PORTABLE HARMONIC GENERATOR

Cat. No. 9169770G1

INTRODUCTION

The Portable Harmonic Generator is a small sine wave generator, designed for its simplicity, and using the rotating machine principle for producing the wave shape. It will produce a 90-cycle fundamental, second, third, fourth, fifth, and seventh harmonics, which may be produced separately or in any combination. The phase of all the harmonics may be shifted with respect to the fundamental.

RECEIVING HANDLING AND STORAGE

Immediately upon receipt of the Portable Harmonic Generator, examine the equipment for any damage that may have been sustained in transit. If injury or rough handling is evident, a damage claim should be filed immediately with the transportation company, and the nearest General Electric Apparatus Sales Office should be promptly notified.

Care should be exercised to prevent misalignment of the main shaft or motor. This apparatus should be stored in a clean dry room, and when placed in use after prolonged storage, the oxide film should be removed from the switch contacts.

DESCRIPTION

The Portable Harmonic Generator (Fig. 1) is composed of a common main shaft (3) with the armatures (4) of the harmonic units mounted at suitable intervals along the shaft. Each armature is composed of two rotating disks with the requisite number of poles to produce the desired frequency. These poles produce impulses in the circuit of the stationary winding. With the exception of the fundamental, these windings are mounted on an adjustable arm (7) which permits rotation about the armature disks to change the phase relationships of the circuits.

This operation is performed by turning the phase shift dial on the front panel. Each pickup coil (8) is connected to a potentiometer which acts as an amplitude control, and a single-pole double-throw switch which cuts the pickup coil in and out of the circuit.

On the rear of the base is a terminal board (11). Two main output terminals are connected to all generating elements, and the output of any element or combination of elements may be selected by the proper manipulation of the switches and amplitude controls. In addition, the output of the fundamental

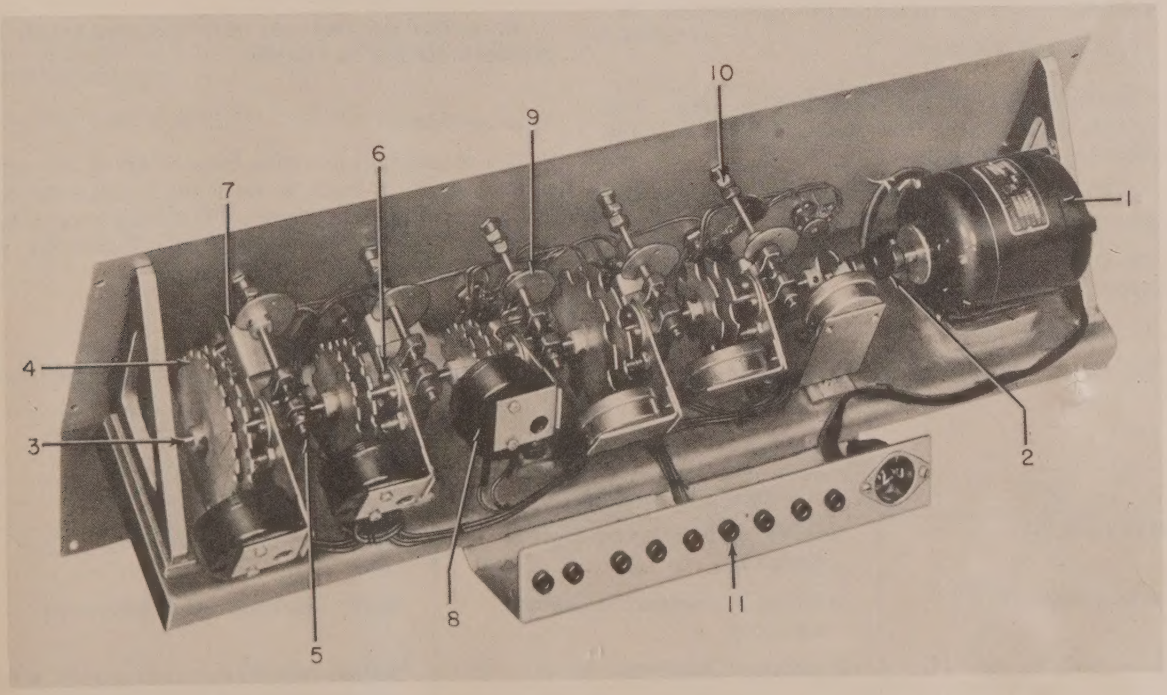


Fig. 1. Portable harmonic generator internal mechanism.

or any harmonic may be obtained by the proper selection of terminals. These terminals are numbered from right to left, facing the rear of the case, Syn., 1, 2, 3, 4, 5, and 7, to correspond to the common side of the circuit and the fundamental, second, third, fourth, fifth, and seventh harmonics respectively. The output of these terminals is controlled only by the amplitude adjustment.

OPERATION

The apparatus should be checked previous to its initial operation. In performing this check, the following steps should be followed:

1. Remove all terminal connections and plugs from the terminal board (Fig. 1, 11).

2. Place the apparatus on its back and remove the front panel with the attached mechanism.

3. Test the motor coupling (2) for tightness.

4. Test the main shaft (3) for free rotation.

5. Test the phase-shift cams (9) for tightness to assure that they are rigidly attached to the shaft.

6. Test the phase-shift arms (7) for rotation and return.

7. Test the pickup coils (8) and adjusting screws for tightness.

8. Replace the panel.

The apparatus is now ready for the initial test. For this operation the following steps should be followed and checks made:

9. Connect the 1/75 horsepower synchronous motor (1) to 115-volt A.C. supply.

10. Connect the output terminals to the vertical input of an oscilloscope.

11. Start the motor.

12. Cut in the fundamental and each harmonic individually and adjust the amplitude and horizontal sweep and observe the wave produced. This wave should be approximately sinusoidal.

13. Turn the phase-shifting dial for each generating element and make sure that it shifts the phase through 360 electrical degrees.

14. Continue with the desired operation. The machine produces approximately 0.2 volt per generating element, and a fundamental frequency of 90 cycles.

MAINTENANCE

INSPECTION

The apparatus should be inspected once a month when operating under normal conditions. Under intermittent operation, inspection prior to usage.

LUBRICATION

Points requiring lubricant are the three bearings of the main shaft, and five bearing surfaces of the phase-shifting arms. These points should be lubricated with a good grade of light oil at each inspection, or more often if necessary. Lubricant should be confined to the bearing surface areas.

REPAIR AND REPLACEMENT

Parts that may become worn and need repair or replacement are as follows:

Pick-up Coils

If a pickup coil becomes inoperative it may need replacement. If such is the case, remove the coil from the phase-shifting arm (7) taking care to lose no parts, and remove leads. To reassemble, the reverse procedure should be used.

Main Shaft

Should it be desirable to renew the main shaft,

PARTS TO INSPECT

PART	POSSIBLE TROUBLE	REMEDY
Main shaft (3)	Scoring or burning on bearing surfaces	Apply lubricant more frequently.
Bearing Supports (5)	Scoring or burning on bearing surfaces	Apply lubricant more frequently.
Phase-shifting Arm (7)	Binding – Looseness	Adjust pressure plate to proper pressure and lubricate bearing surfaces.
Mechanical Connections	Slipping between connected parts	Tighten necessary connections

the following procedure should be used:

1. Note approximate relative position of all armature disks to each other and to the pickup coil.

2. Loosen all bushings, collars, and the motor coupling.

3. Slide shaft through the bearings, taking care not to injure armature disks as they slide off the shaft.

4. To reassemble, slide the new shaft through the bearings, replacing armature disks in their proper position.

5. Replace the shaft coupling.

6. Adjust relative position of disks to coincide with the positions noted in step one.

7. Plug the output of the coils into the oscilloscope and observe the wave shape. Adjust the disks until wave is sinusoidal. If accurate wave shapes are required, the wave should be analyzed and adjusted to produce minimum harmonics.

Support

To replace the bearing support the following steps should be followed:

1. Remove the main shaft as previously indicated.

2. Remove the spring from the phase-shifting arm.

3. Remove the pressure plate and phase-shifting arm from support.

4. Remove the stop pin from the camshaft.

5. Loosen all the collars, bushings and shaft locks, and remove the camshaft.

6. Remove support from the base and dowels, and the stop pin from support.

7. Remove the dowels from the base.

To reassemble the support, the following steps should be applied to the new support.

8. Attach the support to the base loosely.

9. Place the main shaft in position to assure proper alignment and fasten the support securely. The shaft should now turn freely.

10. With the support in this position, drill the base to receive 1/8-in. dowels.

11. Remove the support and set 1/8-in. dowels.

12. Replace the support and fasten securely.

13. Replace the camshaft, with all the collars and bushings in position, and set the stop pin.

14. Replace the phase-shifting arm and fasten the pressure plate securely in position.

15. Attach the spring to the phase-shifting arm.

16. Tighten the collars on the camshaft.

17. The camshaft to the zero position and the cam to the lowest point and tighten the setscrews.

18. Tighten the shaft lock until the desired friction is obtained.

19. Replace the shaft and armature disks as previously indicated.

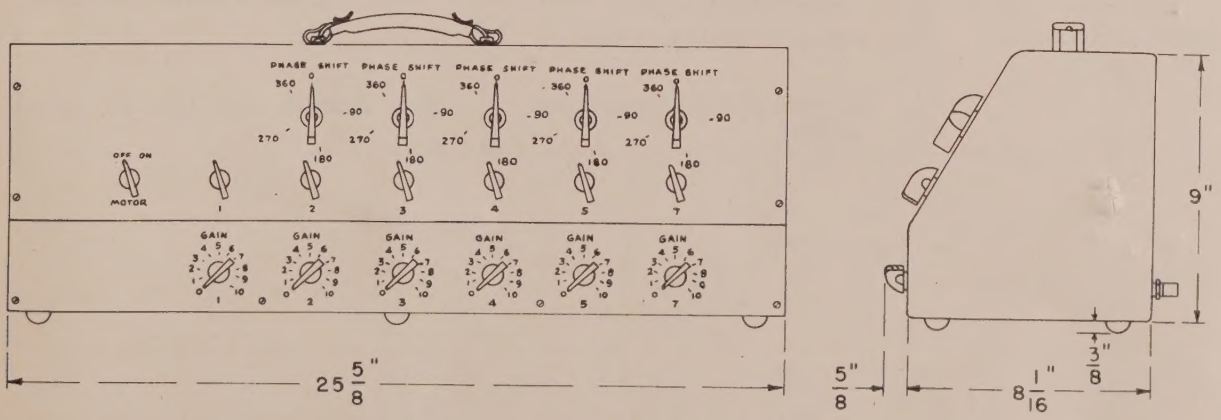


Fig. 2. Portable harmonic generator outline and dimensions.

Pick-up Coils

To repair the pickup coil in case of shorting to the frame the following steps should be followed:

1. The coil and case should be removed from the phase-shifting arm taking care to lose no parts.

2. The magnet should be removed from the case.

3. Cut insulating paper to fit inside of the case.

4. Lift coils and place insulating paper in proper position between the coils and back of the case.

5. Replace the coils and the magnet.

6. Fasten the coil and the case to the phase-shifting arm.

7. Adjust the coil to get the proper voltage and wave shape.

RENEWAL PARTS

When ordering renewal parts, address the nearest General Electric sales office, specify the quantity required, give the catalog number and describe the required parts in detail. Also give the complete nameplate rating of the equipment.

PART		IDENTIFICATION
Pickup Coil	Fundamental 2nd Harmonic 3rd Harmonic	Cannon Ball Empire EC-2
Pickup Coil	4th Harmonic 5th Harmonic 7th Harmonic	Trimm Cat. No. 72-4
Main Shaft		G.E. Dwg. M-9601560-P1
Support		G.E. Dwg. M-9601494-P1

TROUBLE SHOOTING

TROUBLE	PROBABLE CAUSE	REMEDY
No output	Dirty switch contacts	Clean contacts with fine sandpaper or emery cloth
No output from given element	Open pickup coil	Replace coil
Multiple wave shapes from given element	Two or more coils shorted together through frame	Insulate coil from case as previously described.
Excessive 60-cycle pickup	Open circuit	Locate open circuit and make necessary repairs.
Distorted wave shape	Rotating disks have shifted relative to one another	Adjust relative position of disks until sine wave again appears.
	Rotating disks have shifted relative to stator pole faces	Adjust disks so that each rotates directly in front of stator pole piece.
Multiple traces on oscilloscope	Eccentric rotation of shaft	Replace shaft
	All teeth in disks not on same radius	True disks to form a perfect circle.

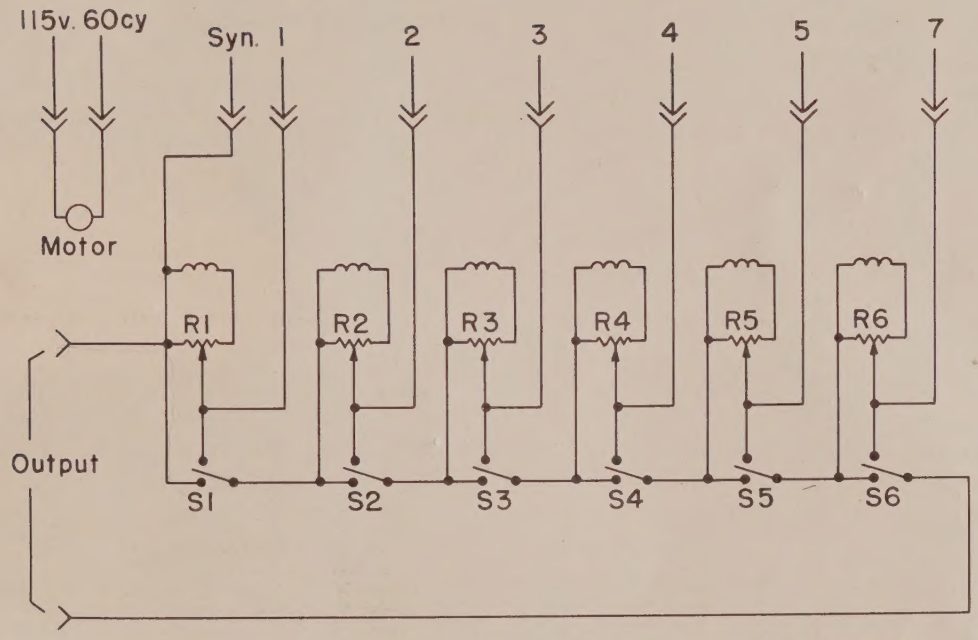


Fig. 3. Portable harmonic (K-9699518) generator elementary diagram.

IF YOU REQUIRE SERVICE

IF AT ANY TIME you find it necessary to repair, recondition, or rebuild your G-E apparatus, there are 29 G-E service shops whose facilities are available day and night for work in the shops or on your premises. Factory methods and genuine G-E renewal parts are used to maintain the original performance of your G-E apparatus. If you need parts only, immediate shipment of many items can be made from warehouse stock.

The services of our factories, engineering divisions, and sales offices are also available to assist you with engineering problems. For full information about these services, contact the nearest service shop or sales office listed below:

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Atlanta 3, Ga. . . . . 496 Glenn St., S. W.
*Baltimore 30, Md. . . . . 920 E. Fort Ave.
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San Francisco 3, Calif. . . . . 1098 Harrison St.
Seattle 4, Wash. . . . . 3422 First Ave., S.
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*Convenient G-E Renewal Parts Center for-over-the-counter purchases of industrial parts, located at same address.

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